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Adams et al.

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[54] **DUMP CONTROL FOR LOADERS**

[75] Inventors: **Stanley B. Adams**, Yorkville; **Michael P. Morge**, Oswego, both of Ill.

[73] Assignee: **Caterpillar Tractor Co.**, Peoria, Ill.

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[51] **Int. Cl.**[2] **E02F 3/84**

[52] **U.S. Cl.** **214/762**; 37/DIG. 1

[58] **Field of Search** ..... 214/764, 762, 142; 212/35 HC; 37/DIG. 1

[56] **References Cited**

U.S. PATENT DOCUMENTS

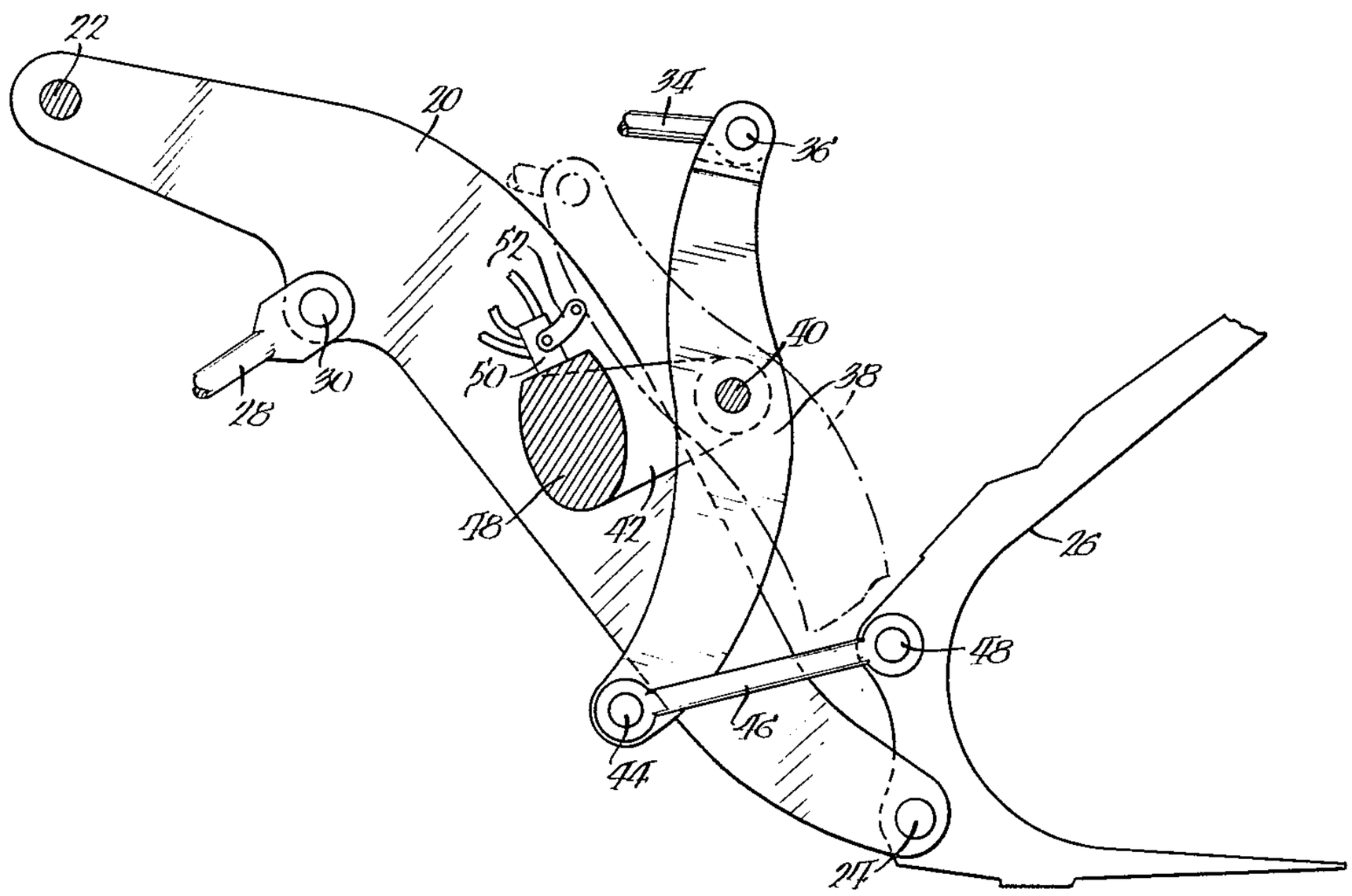
3,494,495	2/1970	Alderman et al.	214/762
3,522,897	8/1970	Freedy	214/764
3,836,032	9/1974	Geier	214/764
3,929,245	12/1975	Inoue	214/764
4,011,959	3/1977	Papasideris	214/762

Primary Examiner—Albert J. Makay
Assistant Examiner—Ross Weaver
Attorney, Agent, or Firm—Wegner, Stellman, McCord, Wiles & Wood

[57] **ABSTRACT**

A loader having a vehicle frame, a load lifter, a pair of arms each having one end pivoted to the frame and the other ends pivoted to the load lifter, at least one tilt cylinder carried by the arms and having an extendable rod, first links pivoted intermediate their ends to respective arms and at their ends to the rods and to second links. The second links are pivoted to the load lifter and there is included a hydraulic system including a manual actuator for controlling the cylinder to pivot the load lifter between forward and rearward positions on the arms. The invention contemplates a hydraulic element for sensing the position of the load lifter and for halting the flow of hydraulic fluid to and from the cylinder when the load lifter is moving forwardly on the arms just short of the forward position to halt such movement and provide a hydraulic cushioning effect.

4 Claims, 3 Drawing Figures



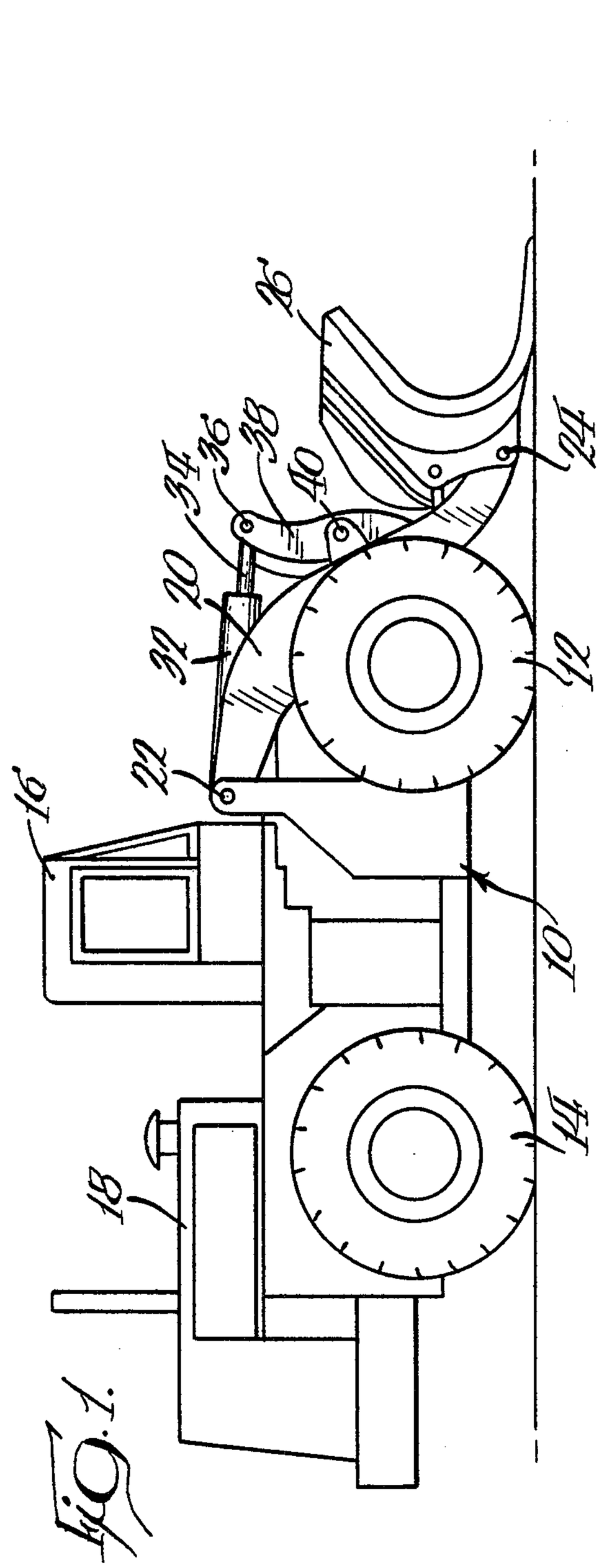

16'
22
20
31
18
26
34
36
38
40
24
12
10
14

FIG. 1.

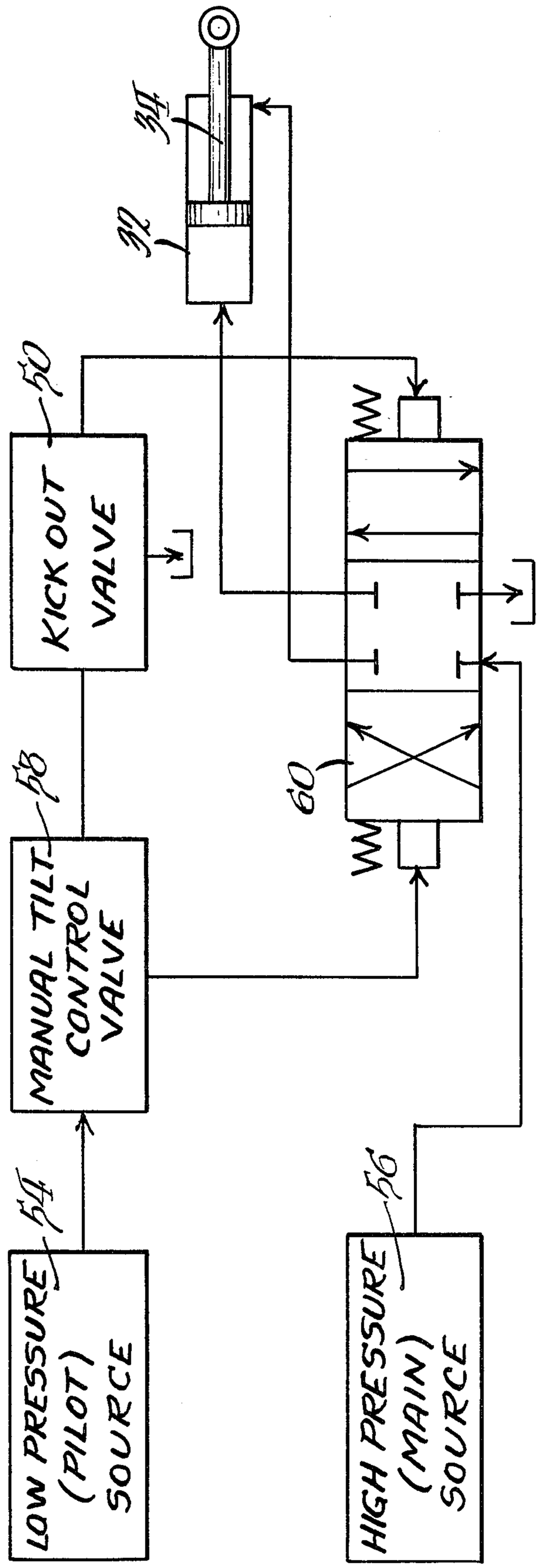
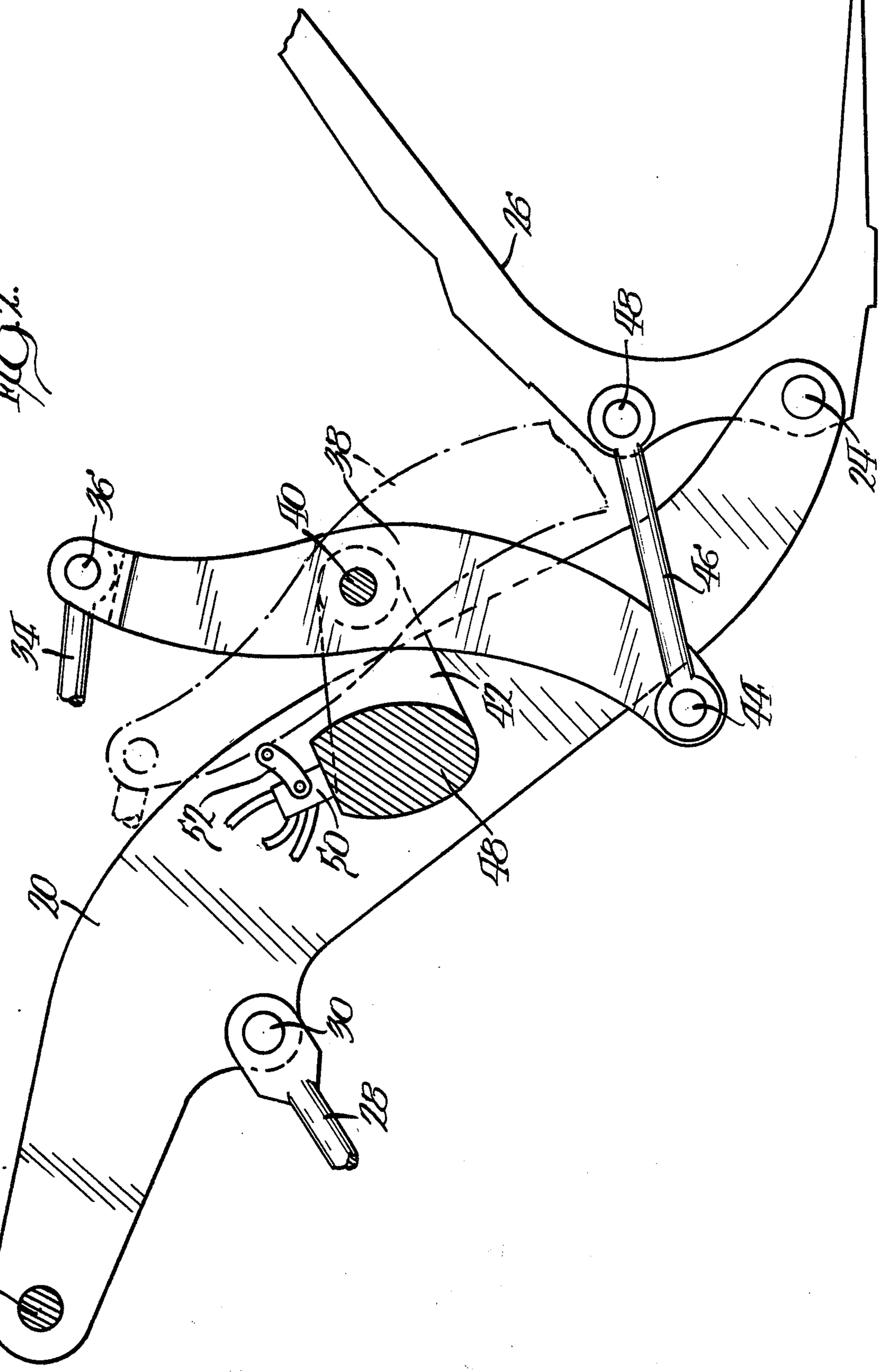

KICK OUT VALVE
50
MANUAL TILT CONTROL VALVE
58
LOW PRESSURE (PILOT) SOURCE
54
32
60
HIGH PRESSURE (MAIN) SOURCE
56

FIG. 3.

Fig. 2.



DUMP CONTROL FOR LOADERS

BACKGROUND OF THE INVENTION

This invention relates to loaders and, more specifically, to improved controls for dumping devices on loaders.

Loaders of varying sort art being manufactured in ever-increasing size to provide increased loading capacity. With the increased load capacity, there is, however, an increased problem of stressing of linkages and cylinders, particularly when the load on a load lifter, such as a fork or a bucket, is being dumped. The stresses are acute when mechanical stops are utilized to position the load lifter in its dump position.

SUMMARY OF THE INVENTION

The present invention is directed to overcoming one or more of the problems as set forth above.

According to the present invention, the loader has a vehicle frame, a load lifter, a pair of arms, each having one end pivoted to the frame and the other end pivoted to the load lifter, and at least one cylinder carried by the arms and having an extendable rod. A first link is pivoted intermediate its ends to an arm and at its ends to the rod and to a second link. The second link is pivoted to the load lifter and a hydraulic system, including a manual actuator, it utilized for controlling the cylinder to pivot the load lifter between forward and rearward positions on the arms, the forward position corresponding to a dump position. The improved vehicle includes a means for sensing the position of the load lifter and for halting the flow of hydraulic fluid to and from the cylinder when the load lifter is moving forwardly on the arms just short of the forward position to thereby stop movement of the load lifter and hydraulically cushion the same without the load lifter bottoming out against mechanical stops.

Other objects and advantages will become apparent from the following specification taken in connection with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of a loader made according to the invention;

FIG. **2** is an enlarged, fragmentary view of a portion of the lift mechanism of the loader with parts shown in section; and

FIG. **3** is a schematic of a hydraulic system employed in the loader.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An exemplary embodiment of a loader made according to the invention is illustrated in FIG. **1** and is seen to include a vehicle frame, generally designated **10**, having forward and rear wheels **12** and **14**, respectively. The frame **10** mounts a cab **16** which may be occupied by an operator of the vehicle in a conventional fashion as well as an engine **18** which drive the vehicle over the underlying terrain and drives a hydraulic pump or the like for providing hydraulic fluid under pressure to cylinders for performing various functions to be described hereinafter.

At the forward end of the frame **10**, a pair of lift arms **20** are pivoted as at **22** to the frame and as at **24** to a load lifter **26** which, according to the present invention, is a lifting fork, but could be a bucket or the like.

As seen in FIG. **2**, the rod **28** of a hydraulic cylinder (not shown) is pivotally connected at **30** to the lift arm **20** intermediate its ends. Those skilled in the art will recognize that operation of the hydraulic cylinder associated with the rod **28** will cause elevation or dropping of the arms **20** about the pivot **22**. In general, there will be a cylinder and associated rod **28** for each of the lift arms **20**.

Returning to FIG. **1**, a pair of cylinders **32** (only one of which is shown) are pivotally connected to associated sides of the frame **10** adjacent the pivots **22**. The cylinders **32** are double-acting and have rods **34** which are pivotally connected as at **36** to the upper ends of links **38** associated with corresponding ones of the lift arms **20**. The links **38** are pivoted at **40** intermediate their ends to forwardly projecting ears **42** mounted on corresponding ones of the lift arms **20**. The ends of the links **38** opposite from the pivots **36** are pivotally connected as at **44** to second links **46** which, in turn, are pivotally connected as at **48** to the load lifter **26** at a location above the pivots **24**.

A cross member **48** extends between the lift arms **20** to rigidify the overall structure and similar cross arms may interconnect the links **38**. Mounted on the upper surface of the cross member **48** is a valve **50** having an actuator **52** which is positioned to be engaged by the rear side of one of the links **38** when the same approaches an extreme position of counterclockwise rotation about the pivot **40** which corresponds to a forward movement of the load lifter **26** about the pivot **24** towards its forwardmost position. It is to be specifically noted that the actuator **52** trips the valve **50** just prior to the load lifter **26** attaining its forwardmost position as permitted by the various mechanical structure involved.

The valve **50** is of the type having three ports, one of which may be connected to drain in a hydraulic system to be described in greater detail hereinafter. One port is a supply port and when the valve **50** does not have its actuator **52** tripped, fluid introduced into the supply port will flow to an outlet port to be transmitted elsewhere in the system. When the actuator **52** is tripped, pressure at the outlet port is directed to the drain port and the supply port is cut off.

Turning now to FIG. **3**, a hydraulic control circuit employing the valve **50** is illustrated. The circuit includes a low pressure source **54** of hydraulic fluid, which low pressure fluid is utilized as a pilot actuator as will be seen. The system also includes a high pressure fluid source **56** which provides fluid under pressure for operating the cylinder **32** as well as the cylinders (not shown) associated with the rods **28**.

Within the cab **16** there is located a manual tilt control valve **58** which may be of conventional construction and the system is completed by a double piloted, self-centering, closed center, four-way valve **60**.

The low pressure source **54** provides pilot fluid to the control valve **58** which is utilized for shifting the spool of the valve **60**. For one position of the control valve, the spool may be shifted to the right, as viewed in FIG. **3**, to cause extension of the cylinder rod **34** to move the load lifter **26** to its rearward position on the arms. Alternately, the control valve may be operated to direct pilot fluid through the valve **50** to the valve **60** to shift the spool to the left, as viewed in FIG. **3**, to cause retraction of the rod **34** of the cylinder **32** and move the load lifter **26** towards its forwardmost position on the arms **20**. Finally, the control valve may be operated so as to

preclude the flow of fluid to either of the pilots associated with the valve **60** whereupon the self-centering action of the same will cause the spool to assume the position illustrated in FIG. **3** in which fluid flow, both to and from the cylinder **32**, will be blocked.

Throughout the vast majority of the operating cycle of the mechanism, the valve **50** will be open to direct pilot fluid to the valve **60** to shift the spool to the left, assuming that the valve **58** is directing pilot fluid to the valve **50**. However, when the forwardmost position of the load lifter **26** is approached, the links **38** will engage the actuator **52** of the valve **50** to cut off the supply and connect the associated pilot of the valve **60** to reservoir to relieve leftward urging pilot pressure in the valve **60**. Since, at this time, the valve **58** will not be directing pilot fluid to the valve **60** such as would urge the spool to the right, the self-centering action of the valve **60** will cause the same to center thereby trapping fluid on both sides of the piston within the cylinder **32** prior to mechanical abutment of structure associated with the load lifter **26** when in its forwardmost position. As a consequence, the trapped columns of fluid act as a hydraulic cushion halting further forward movement of the load lifter **26** and thereby prevent the generation of high stresses associated with mechanical stops which could result in fatigue to the links and/or buckling of the cylinders, including the rods **34**.

It will be appreciated by those skilled in the art that the present system inexpensively and economically provides a means for not only preventing undesirable mechanical contact of the load lifter **26** against mechanical stops, but additionally provides hydraulic cushioning of the same when the forwardmost position is approached to prevent damage to mechanical components.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A vehicle having a frame, a load lifter, a pair of arms each having one end pivoted to the frame and the other end pivoted to the load lifter, at least one tilt cylinder carried by the arms and having an extendable rod, a first link pivoted intermediate its ends to an arm and at its ends to said rod and to a second link, said second link being pivoted to said load lifter, a hydraulic system including a manual actuator for controlling the cylinder to pivot the load lifter between forward and rearward positions on the arms, means for sensing the position of said load lifter and for halting the flow of hydraulic fluid to and from said cylinder when said load lifter is moving forwardly on said arms just short of said forward position to trap hydraulic fluid within said cylinder to act as a hydraulic cushion halting further forward movement of said load lifter, and a cross member extending between said arms, said sensing means comprises a sensing valve mounted on said cross member and having an actuator positioned to be engaged by said first link.

2. The loader of claim **1** wherein said hydraulic system includes a four-way, self-centering, double piloted valve connected to said cylinder, and wherein said sensing valve is operable to block the flow of pilot fluid to one of the pilots of said four-way valve, whereby said four-way valve will center to halt the flow of hydraulic fluid to and from said cylinder to hydraulically cushion said forward movement of said load lifter.

3. The vehicle of claim **1** wherein said cylinder is double acting and wherein said hydraulic system includes means for providing hydraulic fluid under high and low pressures; a double piloted, self-centering, four-way valve connected to said cylinder for directing high pressure fluid to either side thereof and for preventing the flow of fluid to or from said cylinder, a manual control valve for directing low pressure fluid to one pilot of said four-way valve to cause the four-way valve to direct high pressure fluid to one side of the cylinder to cause the load lifter to move rearwardly on said arms and for directing low pressure fluid to the other pilot of said four-way valve to cause said four-way valve to direct high pressure fluid to the other side of said cylinder to cause the load lifter to move forwardly on said arms, said sensing valve being operatively interposed between said manual control valve and said other pilot.

4. The vehicle of claim **1** wherein said sensing valve is mounted on the upper surface of said cross member and said actuator is positioned to be engaged by said first link at a position intermediate the ends of said first link.

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